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اللافقریات	اسم المادة باللغة العربية
<b>Invertebrates</b>	اسم المادة باللغة الانكليزية
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<b>Annelida</b>	عنوان المحاضرة باللغة الإنكليزية
6	رقم المحاضرة

## Phylum: Annelida

Phylum Annelida consists of the segmented worms. It is a large phylum, numbering approximately 15,000 species, the most familiar of which are earthworms and freshwater worms (oligochaetes) and leeches (hirudineans).

### *Characteristics of Phylum Annelida*

1. Body metameric; symmetry bilateral.
2. Body wall with outer circular and inner longitudinal muscle layers; outer transparent moist cuticle secreted by epithelium.
3. Chitinous setae often present; setae absent in leeches.
4. Coelom (schizocoel) well developed and divided by septa, except in leeches; coelomic fluid supplies turgidity and functions as hydrostatic skeleton.
5. Circulatory system closed and segmentally arranged; respiratory pigments (hemoglobin, hemerythrin, or chlorocruorin) often present; amebocytes in blood plasma.
6. Digestive system complete and not metamerically arranged.
7. Respiratory gas exchange through skin, gills, or parapodia.
8. Excretory system typically a pair of nephridia for each metamere.
9. Nervous system with a double ventral nerve cord and a pair of ganglia with lateral nerves in each metamere; brain a pair of dorsal cerebral ganglia with connectives to cord
10. Hermaphroditic or separate sexes; larvae, if present, are trochophore type; asexual reproduction by budding in some.

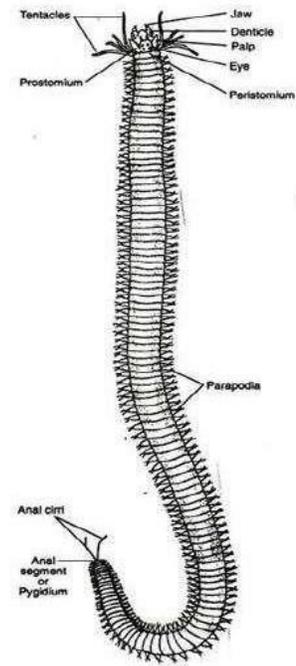
### *Classification:*

<b>Class Polychaeta:</b> Mostly marine; head distinct and bearing eyes and tentacles; most segments with parapodia (lateral appendages) bearing tufts of many setae; clitellum absent; sexes	usually separate; gonads transitory; asexual budding in some; trochophore larva usually present; mostly marine. Examples: <i>Nereis</i> .
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**Class Oligochaeta.** Body with conspicuous segmentation; number of segments variable; setae few per metamere; no parapodia; head absent; coelom spacious and usually divided by intersegmental septa; hermaphroditic; development direct, no larva; chiefly terrestrial and freshwater. Examples: *Lumbricus*,

**Class Hirudinea** Body with fixed number of segments (normally 34; 15 or 30 in some groups) with many annuli; oral and posterior suckers usually present; clitellum present; no parapodia; setae absent (except in *Acanthobdella*); coelom closely packed with connective tissue and muscle; development direct; hermaphroditic; terrestrial, freshwater, and marine. Examples: *Hirudo*

**Example: *Nereis*** The body of *Nereis* is approximately 7-8 centimeters in length. The colour is light violet and the regions of the body which are richly supplied with blood vessels appear reddish. The body is divisible into about 80 segments and a distinct head is present at the anterior end. All the segments excepting the head and the last segment bear laterally placed, hollow, muscular and vertical, movable paired appendages parapodia (Single. Parapodium). The terminal segment is termed as the anal segment or pygidium and it bears at its posterior end a small round opening, the anus. Anal segment bears a pair of elongated anal cirri. On the ventral surface and near the base of the parapodium lies a nephridial aperture. Thus a pair of nephridiopores is present in each parapodial segment.



#### *The Head:*

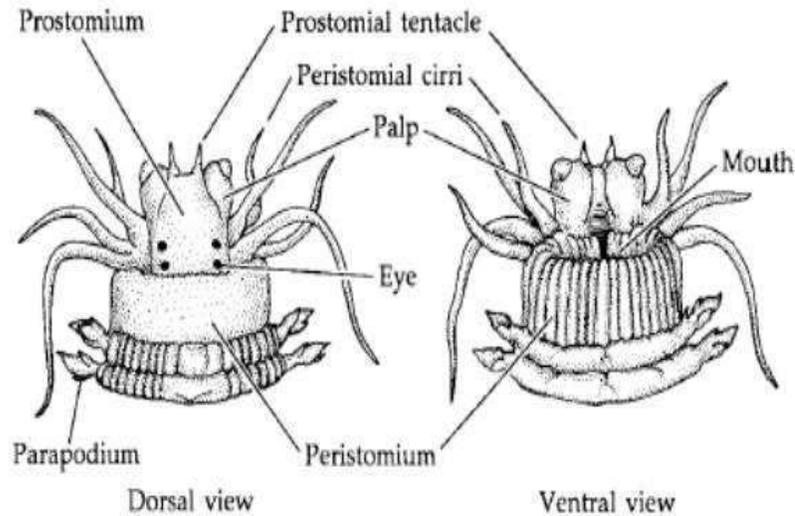
The head is divisible into two parts: prostomium and peristomium. Prostomium is an anterior, small, roughly conical lobe of the peristomium. It lies in front of the mouth. It is not a true body segment. The lobe bears tentacles, palps and eyes which serve as sensory organs. Peristomium is the first body segment which is ring-like and bears mouth ventrally.

The prostomium bears following structures:

- (1) Prostomial Tentacles—paired, cylindrical, small and placed in front.
- (2) Palp—paired, elongated and compact and located after the tentacles.
- (3) Eyes—two pairs, simple, round, pigmented and present on the dorsal side of the head. The peristomium carries:

- (1) Peristomial tentacles—four pairs, long, slender, cylindrical and laterally placed.

(2) Mouth—present on the ventral side as a transverse aperture.

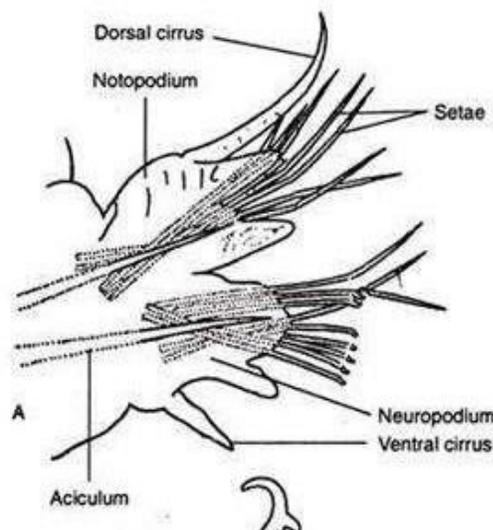


### *Parapodium:*

All the segments excepting the first and the last segments bear on either lateral side a fleshy, flat and hollow parapodium. Largest parapodia are encountered in the middle segments of the body, then the size of the parapodia decreases towards the two ends.

*Parapodium consist of: Dorsally placed notopodium, Ventrally placed neuropodium, Dorsal cirrus, Ventral cirrus, Setae (single Seta) and Aciculum.*

The parapodia perform different locomotory functions, such as crawling and swimming. The parapodia in some polychaetes are highly vascularized structure and function as respiratory organs.



**Setae:** The setae are stiff, needle-like chitinous rods which remain in bundle within a sac in the skin. They have a locomotory function.

**The excretory system:** It consists of series of metamericly arranged paired tubes, called nephridia or segmental organs. They are absent in the anterior and posterior segments.

A nephridium is made up of:

-**nephridial tubule:** long, narrow, highly convoluted and mostly ciliated duct.

-**terminal duct:** it is without cilia and opens to the exterior at the base of the parapodium.

-**nephridiopore:** fine rounded pore, which is capable of being widened or contracted.

-**nephrostome:** ciliated funnel-like opening.

#### *Digestive System:*

Alimentary canal is a straight tube extending from anterior to posterior end of the body. The anterior opening is the **mouth** and posterior opening the **anus**. Mouth is located on ventral side of peristomium and opens into the **buccal cavity**, which carries teeth. **Pharynx** is a large chamber and is lined internally by cuticle. One pair of **jaws** is present at the posterior end of pharynx. Pharynx can be protruded out of mouth by protractor muscles and can be withdrawn by retractor muscles. **Oesophagus** occupies five segments and receives **a pair of glands**. It communicates with stomach–intestine, which is a straight tube that is constricted in each segment. A distinct stomach is absent in *Nereis*. Epithelial lining of mid- gut contains gland cells which secrete digestive enzymes. Rectum is the last part of intestine and opens to outside by anus. *Nereis* is a carnivore and feeds on small animals such as crustaceans, molluscs, sponges and other animals.

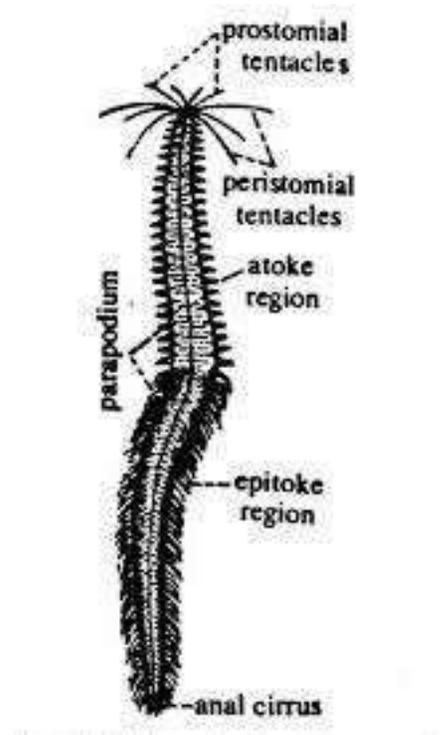
Prey is captured by the eversion of pharynx, which brings the jaws in front to grasp the prey. Retraction is caused by contractions of retractor muscle which brings the prey deep into the pharynx. The ingested food is masticated in the buccopharyngeal region by teeth. Food passes through the intestine by peristalsis and digestion is mainly extracellular and the food is digested by the digestive juices .

**Reproductive System** *Nereis* is dioecious as sexes are separate. Gonads develop only during the breeding season, in the summer months. Gametes are released as spermatogonia in male and as oogonia in female into the coelomic cavity where they undergo maturation to develop

into spermatozoa and ova, respectively. There are no gonoducts and mature sperms and ova are discharged to the outside in water either through nephridial tubules or by the rupture of body wall. Eggs hatch into a larval stage called trochophore. This larva is ciliated, unsegmented and almost pear-shaped. The trochophore swims about by its ciliated bands. Gradually the larva metamorphoses into a young worm which settles at the bottom of the sea and starts burrowing life.

**Heteronereis:** Some species of *Nereis* exhibit dimorphism and two distinct phase. The body is divisible into two parts. The anterior or asexual part is called ‘**Atoke**’ and the posterior or sexual part is called ‘**Epitoke**’. The changes of the posterior half of the body are:

- 1- Parapodia become enlarged.
- 2- Setae become oar-shaped which help in swimming.
- 3- Dorsal and ventral cirri appears to be highly large.
- 4- The notopodium and neuropodium become large and leaf like and act as fins and gills.
- 5- Due to excessive development of gonads, the muscles and alimentary canal are reduced.



**Example: Lumbricus (Earth worm)**

The common earthworm, *Lumbricus terrestris*, or one of its near relatives, is usually used as a type in introductory courses in Zoology.

**External features.** - The body of *Lumbricus* is cylindroid, and varies in length from about six inches to a foot. The segments are easily determined externally because of the grooves extending around the body. At the anterior end a fleshy lobe, the prostomium, projects over the mouth; this is not considered a true segment. Segments 31 or 32 to 37 are swollen in mature worms, forming a saddle-shaped enlargement, the clitellum, of use during reproduction. Every segment except the first and last bears four pairs chitinous bristles, these

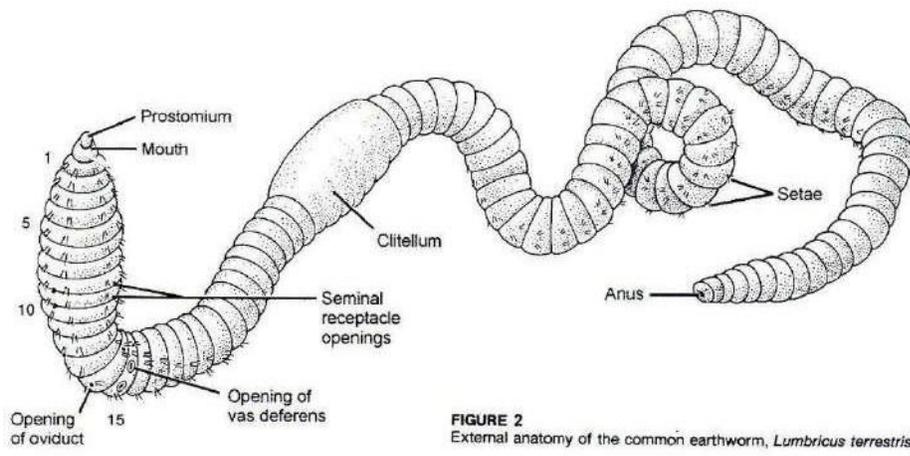
may be moved by retractor and protractor muscles, and are renewed if lost. The setae on segment or somite 26 are, in mature worms, modified for reproductive purposes. The body is covered by a thin, transparent cuticle secreted by the cells lying just beneath it. The cuticle protects the body from physical and chemical injury; it contains numerous pores to allow the secretions from unicellular glands to pass through.

A number of external openings of various sizes allow the entrance of food into the body, and the exit of feces, excretory products, reproductive cells (1) The mouth (2) The oval anal aperture lies in the last somite. (3) The openings of the sperm ducts one on either side of somite 15. (4) The openings of the oviducts, one on either side of somite 14; eggs pass out of the body through them. (5) The openings of the seminal receptacles appear as two pairs of minute pores concealed within the grooves which separate somites 9 and 10, and 10 and 11. (6) A pair of nephridiopores by means of dorsal pores.

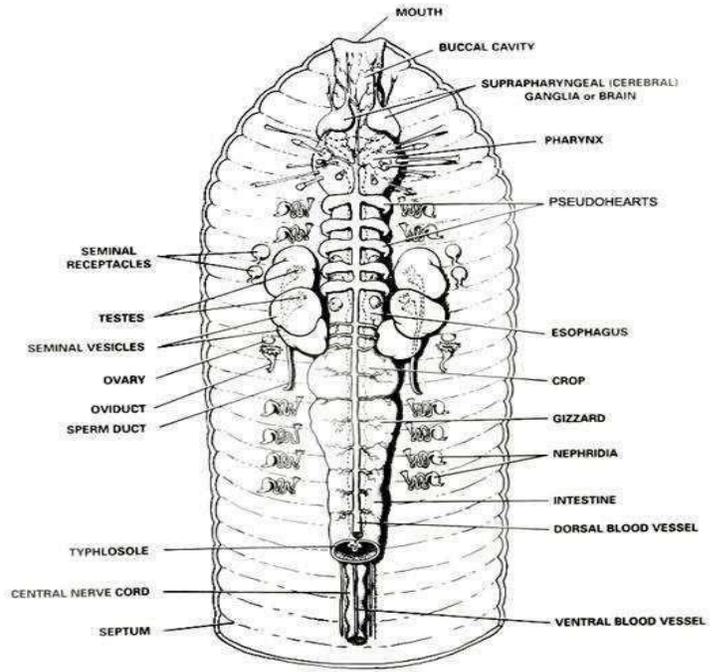
#### *Internal anatomy:*

The body is essentially a double tube, the body wall constituting the outer, the straight alimentary canal, the inner; between the two is a cavity, the coelom. The external segmentation corresponds to an internal division of the coelomic cavity into partitions, called septa, which lie beneath the grooves.

**Digestive system.** - The alimentary canal consists of (1) a mouth cavity or buccal pouch in somites 1 to 3, (2) a thick muscular pharynx lying in somites 4 and 5, (3) a narrow straight tube, esophagus which extends through somites 11 to 14, (4) a thin-walled enlargement, the crop or proventriculus, in somites 15 and 16, (5) a thick muscular-walled gizzard in somites 17 and 18, and, the gizzard is a grinding organ; in it the food is broken up into minute fragments by being squeezed and rolled about. (6) a thin-walled intestine extending from somite 19 to the anal aperture. The intestine is not a simple cylindrical tube; but its dorsal wall is folded, forming an internal longitudinal ridge, the typhlosole. This increases the digestive surface. Surrounding the alimentary canal and dorsal blood vessel is a layer of chloragogen cells. The functions of these cells are not known, but they probably aid in the elaboration of food and are excretory. Three pairs of calciferous glands lie at the sides of the esophagus in segments 10 to 12; they produce carbonate of lime, which probably neutralizes acid foods.



**FIGURE 2**  
External anatomy of the common earthworm, *Lumbricus terrestris*.



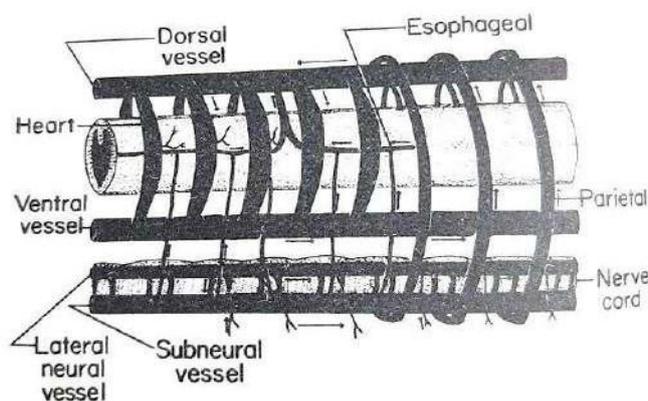
**Excretory system.** - Most of the excretory matter is carried outside of the body by a number of coiled tubes, termed nephridia, a pair of which are present in every somite except the first three and the last.

**Reproduction.** -Both male and female sexual organs occur in a single earthworm. The female system consists of: (1) a pair of ovaries in segment 13; (2) a pair of oviducts which open by a ciliated funnel in segment 13, enlarge into an egg sac in segment 14, and then open to the exterior; and (3) two pairs of seminal receptacles in somites 9 and 10. The male organs are (1) two pairs of glove-shaped testes in segments 10 and 11, (2) two vasa deferentia which lead from ciliated funnels to the exterior in segment 15, and (3) three pairs of seminal vesicles in segments 9, 11, and 12, and two central reservoirs. Self- fertilization does not take place, but spermatozoa are transferred from one worm to another during a process called copulation.

Two worms come together, slime tubes are formed, and then a band-like cocoon is secreted about the clitellar region. Eggs and spermatozoa are deposited in the cocoon, but fertilization does not occur until the cocoon is slipped over the head.

**Respiration.** - The earthworm possesses no respiratory system, but obtains oxygen and gets rid of carbon dioxide through the moist outer membrane.

**Circulation:** The blood of the earthworm circulates through a complex series of closed tubes. Of these, the dorsal blood vessel is largest and is present just dorsal to the digestive tract. It is connected with the smaller ventral blood vessel by a series of 5 pairs of hearts which pass around the digestive tract in segments 7-11.



**Example: *Hirudo medicinalis***

Commonly called Indian Cattle leech. Ectoparasite on cattle and even on man. Setae, prostomium, appendages and distinct head are absent. Only a well-developed posterior sucker is present. The anterior sucker being reduced. Each segment is further divided into 5 annuli except first two and last seven segments. Anterior and posterior segments smaller in size and middle ones larger. First five segments bear paired eyes. Tri-radiate mouth is located on ventral side, proboscis non- protrusible and Jaws three and well developed. Male genital pore is located on 10th and female genital pore on 11th segments mid- ventrally. Hermaphrodite and reproduction sexual. Salivary glands are found in pharyngeal wall secrete anticoagulant enzyme (Hirudin).

